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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,300	06/27/2003	Srinivas Doddi	509982005500	9021

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EXAMINER	
BROWN JR, NATHAN H	

ART UNIT	PAPER NUMBER
2121	

DATE MAILED: 08/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/608,300	DODDI ET AL.	
	Examiner	Art Unit	
	Nathan H. Brown, Jr.	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *(3)* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Examiner's Detailed Office Action

1. This Office is responsive to the communication for application 10/608,300, filed May 15, 2006.

2. Claims 1-29 have been examined and it is noted that: claims 1, 16, and 22 have been amended; claims 2-15, 17-21, and 23-29 remain in their original form.

3. After the third office action, claims 1-29 stand rejected:

Claims 1-6, 11-14, and 16-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Singh et al.* (USPN 6650422 B2) in view of *Wormington et al.* (USPN 6,192,103 B1).

Regarding claim 1. *Singh et al.* describe a method of examining a structure formed on a semiconductor wafer (*see* col. 2, lines 14-17), the method comprising: obtaining a first diffraction signal measured using a metrology device (*see* col. 3, lines 8-12); obtaining a second diffraction signal (*see* col. 3, lines 12-15); comparing the first and second diffraction signals (*see* col. 3, lines 12-15); and when the first and second diffraction signals match within a matching criterion, determining a feature of the structure based on the one or more parameters or the profile (*see* col. 3, lines 15-17). *Singh et al.* do not describe obtaining a second diffraction signal generated using a machine learning system, wherein the machine learning system receives as an

input one or more parameters that characterize a profile of the structure to generate the second diffraction signal. *Wormington et al.* describe obtaining a second diffraction signal generated using such a machine learning system (*see*, Fig. 6 and col. 8, lines 37-40 and col. 5, lines 50-62, *Examiner asserts that genetic and evolutionary algorithms are machine learning algorithms.*). It would have been obvious at the time the invention was made, to persons having ordinary skill in the art, to combine *Singh et al.* with *Wormington et al.* to construct the reflectance signature database with virtually no user intervention (*see* col. 4, lines 8-15).

Regarding claims 2-3. *Singh et al.* describe the method, further comprising: prior to generating the second diffraction signal, training the machine learning system using a set of training input data and a set of training output data, wherein each of the training input data is a profile of the structure characterized by one or more parameters, and wherein each of the training output data is a diffraction signal corresponding to the profile of the structure (*see* col. 9, lines 7-13).

Regarding claim 3. Selecting the set of training input data from a range of profiles of the structure is inherent in the method in that: prior to using the machine learning system (that is a neural network) it must to be trained. Further, the training input and output data must be selected before training can be conducted. Singh teaches that the database of signatures associated with known feature profiles maybe utilized to input training data (*see* col. 9, lines 8-10).

Regarding claim 4. Singh teaches dividing the range of profiles into two partitions. (*see* col.2, lines 25-36). Hence it is inherent to choose two machine-learning systems to learn both partitions under the context set forth by Singh using selected input training data described in claim 3.

Regarding claims 5-6. The admitted prior art on page 1 of the specification [0003]states that the diffraction beam (the output training data) can be analyzed using modeling techniques such as wave analysis.

Regarding claims 11-12. Singh uses the first diffraction signal to compare with profiles in database (col. 3, lines 10-16). Singh also states that the database can be use to train a neural network (col. 9, lines 7-15) that will replace database to generate diffraction signals to compare.

Regarding claims 13-14. Official notice is taken that metrology device is used to measure structure such as ellipsometer using dimension measurement such as n and k values. (See U.S. Patent 5,793,480. col. 2, lin.35-42)

Regarding claims 16-29. Claims 16-21 are computer program claims that implement method claims 1-15 using instruction code and claims 22-29 are systems claims that implement method claims 1-15 using various devices and computers. Therefore claims 16-21 and claims 22-29 are rejected under the same rationale as cited in the rejection of rejected claims 1-15.

Claims 9-10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Singh et al.* in view of *Wormington et al.* and further in view of *Kato* (USPN 6,665, 446 B1).

Regarding claims 9-10 and 15. *Kato* teaches (col. 10, lines 28-32) that neural networks and genetic algorithms are art equivalents and the basic training of a neural network inherently consists of getting input training data, comparing output data with desired values, and acting accordingly with the comparison. Official Notice is taken of the user of a back-propagation algorithm.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Singh et al.* in view of *Wormington et al.* as set forth above and further in view of *Sirat et al.* (EPN 0 448 890 A1).

Regarding claim 7. Using principal component analysis to transform machine-learning system output data is taught (*see* p. 2, lines 39-41) by *Sirat et al.* It would have been obvious at the time the invention was made, to persons having ordinary skill in the art, to combine *Singh et al.* with *Sirat et al.* to obtain fewer and simpler calculations per iteration during training.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Singh et al.* in view of *Wormington et al.* and further in view of *Gahegan et al.*, "Dataspaces as an organizational concept for the neural classification of geographic datasets", 1999.

Regarding claim 8. *Singh et al.* teaches the method of claim 7. *Gahegan et al.* teaches the method, further comprising: dividing the dimensions of the training output data into a first partition and at least a second partition (*see* Fig. 2, *Examiner asserts that any training data is applied to the first (input) layer of units for training and that the second layer of units partitions the feature space of the first layer of units.*), wherein a first machine learning system is configured and trained for the first partition, and a second machine learning system is configured and trained for the second partition (*see* Fig. 2, *Examiner asserts that the self-organizing map neural networks in the third layer are configured to be trained (separately) for a first and second partition of the dimensions of the input space.*). It would have been obvious at the time the invention was made, to persons having ordinary skill in the art, to combine *Singh et al.* with *Gahegan et al.* to apply a 'divide and conquer' approach to training, wherein a different metric or model can be applied to each feature (dimension) sub-space according to its specific structure.

Response to Arguments

4. Applicants' arguments (**I**) filed with respect to the 35 U.S.C. 103(a) rejections of claims 1-6, 11-14, and 16-29 have been fully considered but they are not persuasive. Further, the amendment added to claims 1, 16, and 22 "as an output of the machine learning system" does not distinguish the claimed invention from that of *Wormington et al.*

First, Applicants' claimed invention and *Wormington et al.* use a machine learning system based on optimization techniques. The Applicant's possibly uses error backpropagation or kernel regression (*see* claim 10). *Wormington et al.* use stochastic function minimization in the form of the Differential Evolution algorithm. So, there is no inventive distinction with respect to machine learning being used or not.

Second, both the Applicants' claimed invention and *Wormington et al. simulate* electromagnetic radiation effects. Neither generates actual electromagnetic radiation. The Applicants' claimed invention uses "a profile of the structure" to generate a *simulated* diffraction signal. *Wormington et al.* use parameter vectors to simulate X-ray scattering. Again, there is no substantive inventive distinction and clearly, *Wormington et al.* do teach a machine learning system used to generate a simulated diffraction signal (*Examiner interprets diffraction to be a type of scattering.*)

Third, Applicants' argument that *Wormington et al.* don't generate a simulation of X-ray scattering as *output* at step 40 ignores the fact that step 40, as depicted in Fig 4, is not an output step. In fact, there are no output steps *depicted* in Fig. 4. All boxes in the flowchart shown in Fig. 4 depict computation steps or processes. Standard flowchart representation for output is a parallelogram (*see* 25.4 GUIDELINES FOR DRAWING A FLOWCHART at http://www.nos.org/htm/basic2.htm). Examiner notes that the process box of step 42 is *denoted* as an *output process* by being labeled: "REPORT PARAMETERS". Further, Examiner notes that the same is true for step 406 in Applicants' Fig. 4 and step 506 in Applicants' Fig. 5!

(Examiner notes a possible defect in Applicants' Fig. 5 as only one diffraction signal has been generated by step 508, thus making comparison of diffraction signals problematic.) Examiner infers that in both inventions, any simulated output is by "side effecting" (*see* http://en.wikipedia.org/wiki/Side-effect_(computer_science)). Again, there is no substantive inventive distinction.

Examiner therefore maintains the 35 U.S.C. 103(a) rejections of claims 1-6, 11-14, and 16-29.

5. Applicants' argument (**II**) filed with respect to the 35 U.S.C. 103(a) rejection of claims 9-10 and 15 has been fully considered but is not persuasive. The base claim for claims 9 and 15 is not allowable for the reasons given above.

6. Applicants' argument (**III**) filed with respect to the 35 U.S.C. 103(a) rejection of claim 7 has been fully considered but is not persuasive. The base claim for claim 7 is not allowable for the reasons given above.

7. Applicants' argument (**IV**) filed with respect to the 35 U.S.C. 103(a) rejection of claim 8 has been fully considered but is not persuasive. The base claim for claim 8 is not allowable for the reasons given above.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan H. Brown, Jr. whose telephone number is 571-272- 8632. The examiner can normally be reached on M-F 0830-1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anthony Knight can be reached on 571-272-3687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Nathan H. Brown, Jr.
August 9, 2006

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For Anthony Knight